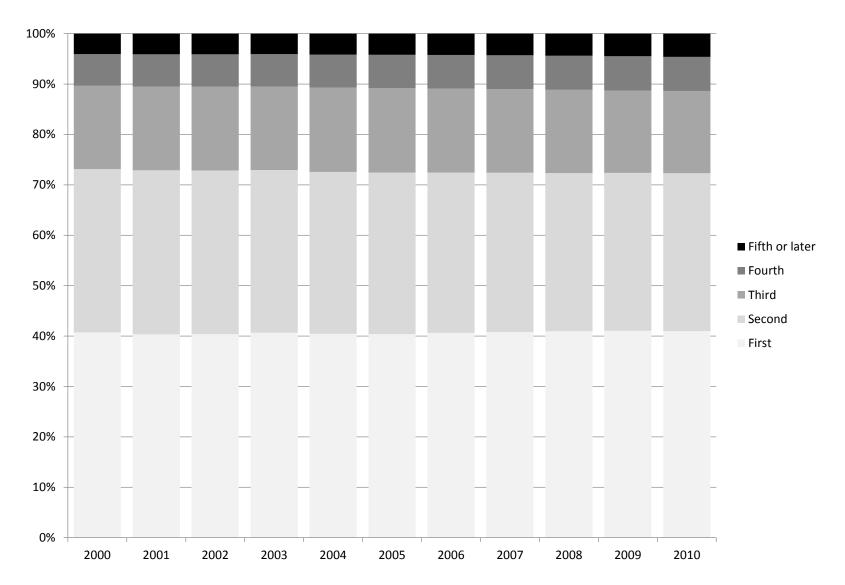
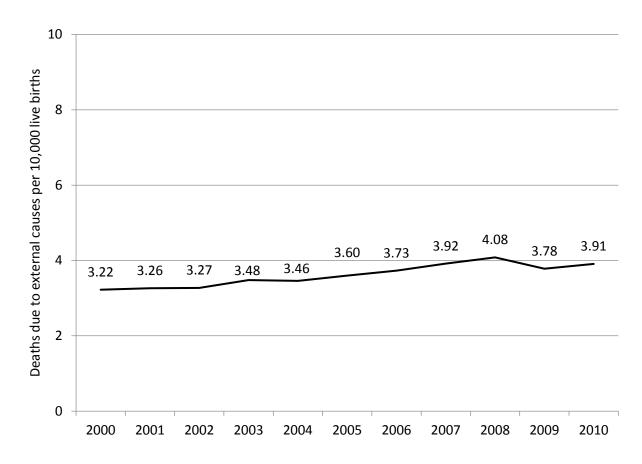
Appendix
Birth Order and Injury-Related Infant Mortality in the U.S.
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Appendix Figure 1. Distribution of live birth order by birth year, singleton births in the U.S., 2000-2010.



Appendix Figure 2. Infant mortality due to external causes by birth year, singleton births in the U.S., 2000-2010.



Linear trend *p*-value < 0.0001

Appendix Table 1. Selected Maternal and Infant Characteristics for Live Births and Infant Deaths due to External Causes Among First and Second Born Infants, Singleton Births in the U.S., 2000-2010

Maternal and infant			First		Second					
characteristics	Live bir	ths	Deaths due	to external	Live bir	ths	Deaths due	to external		
			cau	ises			cau	ises		
	na	Est.	n ^b	Est.	na	Est.	n ^b	Est.		
All	17,759,256	100.0	5,110	100.0	13,946,108	100.0	4,990	100.0		
Maternal age at time of birth	17,759,256	25.1	5,110	21.5	13,946,108	27.9	4,990	23.6		
(years), mean										
Maternal age at time of birth (year	rs)/%									
Under 20	3,750,558	21.1	2,217	43.4	752,965	5.4	1,021	20.5		
20-24	5,300,981	29.8	1,829	35.8	3,694,210	26.5	2,341	46.9		
25-29	4,364,947	24.6	646	12.6	4,007,439	28.7	959	19.2		
30-34	2,919,742	16.4	260	5.1	3,528,740	25.3	438	8.8		
35-39	1,144,029	6.4	119	2.3	1,617,961	11.6	186	3.7		
40-54	278,999	1.6	39	0.8	344,793	2.5	44	0.9		
Maternal race/ethnicity,%										
Hispanic	3,706,956	20.9	715	14.0	3,097,847	22.2	748	15.0		
Non-Hispanic white	10,197,175	57.4	2,822	55.2	8,007,256	57.4	2,733	54.8		
Non-Hispanic black	2,473,453	13.9	1,271	24.9	1,810,538	13.0	1,243	24.9		
Other ^c	1,381,672	7.8	303	5.9	1,030,467	7.4	266	5.3		
Maternal marital status at time of b	oirth,%									
Not married	7,950,424	44.8	3,792	74.2	4,352,351	31.2	3,165	63.4		
Married	9,808,832	55.2	1,319	25.8	9,593,757	68.8	1,825	36.6		
Maternal educational attainment at	t time of birth ^d	,%								
No high school diploma or	3,463,123	19.5	1,862	36.4	2,440,278	17.5	1,652	33.1		
GED										
High school diploma or GED	8,967,761	50.5	2,784	54.5	7,377,292	52.9	2,897	58.1		
Bachelor's degree or higher	5,112,436	28.8	391	7.7	3,977,087	28.5	378	7.6		

Not stated or unknown	215,936	1.2	74	1.4	151,451	1.1	62	1.2
Maternal tobacco use during pregn	nancy ^e ,%							
No	13,862,174	78.1	3,318	64.9	10,770,116	77.2	3,010	60.3
Not stated or unknown	2,559,325	14.4	752	14.7	2,012,941	14.4	708	14.2
Gestational week at birth,%								
<37 (preterm birth)	1,866,246	10.6	957	19.2	1,341,329	9.7	938	19.9
37-39	8,472,952	47.7	2,262	44.3	8,019,265	57.5	2,573	51.6
40	4,066,245	22.9	981	19.2	2,607,521	18.7	781	15.7
41	2,049,953	11.5	484	9.5	1,096,813	7.9	330	6.6
42 or over	1,213,245	6.8	373	7.3	800,157	5.7	336	6.7
Unknown or not stated	90,615	0.5	53	1.0	81,023	0.6	32	0.6
Birthweight (g) ,%								
Low birthweight	1,317,547	7.4	875	17.2	706,562	5.1	687	13.8
Under 1,500	249,541	1.4	222	4.3	119,121	0.9	134	2.7
1,500-2,499	1,068,006	6.0	653	12.8	587,441	4.2	552	11.1
2,500 or over	16,439,712	92.6	4,220	82.6	13,238,406	94.9	4,299	86.2
Unknown or not stated	1,997	0.0	15	f	1,140	0.0	5	f
Sex,%								
Female	8,651,715	48.7	2,135	41.8	6,802,784	48.8	2,118	42.4
Male	9,107,541	51.3	2,975	58.2	7,143,324	51.2	2,873	57.6
OTT 1 1								

^aUnweighted counts of live births.

GED, general educational development test

^bWeighted infant death counts; may not sum to total due to rounding.

^cIncludes Asian or Pacific Islander, American Indian or Alaska Native, other, and Hispanic origin unknown or not stated.

^dMaternal education categories were collapsed from the 1989 birth certificate revision (<12 years, 12−15 years, and ≥16 years) to approximately correspond with combined categories from the 2003 birth certificate data (<high school, high school, Bachelor's degree or higher).

^eAny tobacco use or any cigarettes smoked during pregnancy.

^fPercentage does not meet standards of reliability or precision.

Appendix Table 2. Selected Maternal and Infant Characteristics for Live Births and Infant Deaths due to External Causes Among Third, Fourth, and Fifth or Later Born Infants, Singleton Births in the U.S., 2000-2010

Maternal and infant		Tł	nird			For	ırth		Fifth or later				
characteristics	Live births Deaths due to external causes			Live bii	rths		due to	Live bir	ths		due to		
	n ^a	Est.	n ^b	Est.	na	Est.	n ^b	Est.	na	Est.	n ^b	Est.	
All	7,240,241	100.0	3,008	100.0	2,874,403	100.0	1,380	100.0	1,859,124	100.0	1,187	100.0	
Maternal age at time of	7,240,241	29.4	3,008	25.6	2,874,403	30.5	1,380	26.9	1,859,124	32.5	1,187	29.9	
birth (years), mean	, ,		,				ŕ				,		
Maternal age at time of birt	h (years), %												
Under 20	113,415	1.6	179	6.0	13,105	0.5	34	2.5	1,781	0.1	5	f	
20-24	1,451,642	20.0	1,350	44.9	406,949	14.2	461	33.4	124,280	6.7	185	15.6	
25-29	2,220,908	30.7	873	29.0	870,013	30.3	531	38.5	452,595	24.3	439	37.0	
30-34	2,059,462	28.4	403	13.4	881,982	30.7	239	17.3	600,149	32.3	295	24.9	
35-39	1,142,981	15.8	172	5.7	554,489	19.3	95	6.9	484,123	26.0	205	17.3	
40-54	251,833	3.5	31	1.0	147,865	5.1	20	1.4	196,196	10.6	58	4.9	
Maternal race/ethnicity, %													
Hispanic	1,971,333	27.2	452	15.0	878,459	30.6	213	15.4	544,840	29.3	167	14.1	
Non-Hispanic white	3,781,543	52.2	1,540	51.2	1,337,778	46.5	609	44.1	783,257	42.1	436	36.7	
Non-Hispanic black	1,082,166	14.9	868	28.9	506,832	17.6	475	34.4	416,153	22.4	499	42.0	
Other ^c	405,199	5.6	148	4.9	151,334	5.3	84	6.1	114,874	6.2	85	7.2	
Maternal marital status at ti	me of birth, 9	6											
Not married	2,316,327	32.0	1,808	60.1	1,016,945	35.4	863	62.5	725,140	39.0	746	62.8	
Married	4,923,914	68.0	1,199	39.9	1,857,458	64.6	517	37.5	1,133,984	61.0	441	37.2	
Maternal educational attain	ment at time	of birth ^d ,	%										
No high school	1,711,681	23.6	1,078	35.8	886,047	30.8	570	41.3	737,213	39.7	522	44.0	
diploma or GED													
High school diploma	3,934,894	54.3	1,708	56.8	1,525,487	53.1	728	52.8	903,022	48.6	598	50.4	
or GED													
Bachelor's degree or	1,506,839	20.8	186	6.2	422,243	14.7	57	4.1	183,080	9.8	45	3.8	
higher													
Not stated or unknown	86,827	1.2	35	1.2	40,626	1.4	24	1.7	35,809	1.9	21	1.8	
Maternal tobacco use during													
No	5,441,987	75.2	1,656	55.1	2,102,611	73.1	759	55.0	1,330,955	71.6	646	54.4	
Yes	723,218	10.0	896	29.8	325,579	11.3	409	29.6	233,167	12.5	353	29.7	

Not stated or unknown	1,075,036	14.8	456	15.2	446,213	15.5	212	15.4	295,002	15.9	188	15.8
Gestational week at birth, %	,)											
<37 (preterm birth)	778,375	10.8	587	20.8	354,905	12.4	289	22.6	267,062	14.5	303	27.7
37-39	4,164,270	57.5	1,560	51.8	1,609,355	56.0	717	51.9	972,970	52.3	587	49.5
40	1,280,775	17.7	444	14.8	497,681	17.3	204	14.8	327,084	17.6	140	11.8
41	544,734	7.5	197	6.5	216,876	7.5	77	5.6	153,251	8.2	76	6.4
42 or over	423,164	5.8	202	6.7	172,042	6.0	79	5.7	118,815	6.4	70	5.9
Unknown or not stated	48,923	0.7	18	f	23,544	0.8	15	f	19,942	1.1	11	f
Birthweight (g), %												
Low birthweight	396,233	5.5	425	14.1	183,151	6.4	206	14.9	146,225	7.9	220	18.5
Under 1,500	66,184	0.9	96	3.2	31,750	1.1	43	3.1	26,361	1.4	43	3.6
1,500-2,499	330,049	4.6	329	10.9	151,401	5.3	162	11.7	119,864	6.4	176	14.8
2,500 or over	6,843,331	94.5	2,582	85.8	2,690,894	93.6	1,173	85.1	1,712,521	92.1	966	81.5
Unknown or not stated	677	0.0	1	f	358	0.0	1	f	378	0.0	1	f
Sex, %												
Female	3,539,389	48.9	1,310	43.6	1,407,914	49.0	583	42.2	912,139	49.1	555	46.8
Male	3,700,852	51.1	1,698	56.4	1,466,489	51.0	797	57.8	946,985	50.9	632	53.2

^aUnweighted counts of live births.

GED, general educational development test

^bWeighted infant death counts; may not sum to total due to rounding

^cIncludes Asian or Pacific Islander, American Indian or Alaska Native, other, and Hispanic origin unknown or not stated.

^dMaternal education categories were collapsed from the 1989 birth certificate revision (<12 years, 12−15 years, and ≥16 years) to approximately correspond with combined categories from the 2003 birth certificate data (<high school, high school, Bachelor's degree or higher).

^eAny tobacco use or any cigarettes smoked during pregnancy.

^fPercentage does not meet standards of reliability or precision.

Appendix Table 3. Distribution of Infant Deaths due to External Causes by Selected Infant Death Characteristics and Live Birth Order, Singleton Births in the U.S., 2000-2010

Infant death characteristics	Total de	aths due	F	irst	Se	cond	Tł	nird	Fo	urth	Fifth	or later
	to ext	ernal										
	cau	ses										
	n ^{a,b}	Col %	nª	Col %	nª	Col %	nª	Col %	na	Col %	nª	Col %
All	15,865	100.0	5,110	100.0	4,990	100.0	3,008	100.0	1,380	100.0	1,187	100.0
Age at death (days)												
Total neonatal	1,714	10.8	605	11.8	441	8.8	288	9.6	150	10.9	129	10.9
Early neonatal (under 7)	555	3.5	225	4.4	115	2.3	58	1.9	33	2.4	28	2.4
Late neonatal (7-27)	1,159	7.3	380	7.4	326	6.5	230	7.6	117	8.5	101	8.5
Post-neonatal (28-365)	14,151	89.2	4,505	88.2	4,550	91.2	2,720	90.4	1,231	89.1	1,057	89.1
Early post-neonatal (28-90)	5,302	33.4	1,737	34.0	1,651	33.1	1,024	34.1	454	32.9	404	34.0
Early middle post-neonatal (91-182)	4,486	28.3	1,399	27.4	1,483	29.7	865	28.8	391	28.3	319	26.9
Late middle post-neonatal (183-273)	2,517	15.9	790	15.5	811	16.2	489	16.3	221	16.0	193	16.3
Late post-neonatal (274-365)	1,846	11.6	579	11.3	605	12.1	341	11.3	165	11.9	142	12.0
External causes of mortality												
Accidents (unintentional injuries)	11,403	71.9	3,493	68.4	3,594	72.0	2,262	75.2	1,059	76.7	923	77.8
Transport accident	1,344	8.5	568	11.1	369	7.4	216	7.2	103	7.5	79	6.7
Falls	179	1.1	48	0.9	72	1.4	32	1.1	11	c	14	c
Firearms	5	c	1	c	2	c	1	с	1	c	d	c
Drowning/submersion	574	3.6	117	2.3	222	4.4	118	3.9	65	4.7	49	4.1
Accidental suffocation and	5,663	35.7	1,684	32.9	1,757	35.2	1,161	38.6	545	39.5	480	40.5
strangulation in bed												
Other strangulation/suffocation	1,947	12.3	549	10.7	642	12.9	419	13.9	183	13.3	143	12.1
Obstruction respiratory tract	619	3.9	195	3.8	210	4.2	106	3.5	53	3.8	51	4.3
Smoke, fire, flames	318	2.0	68	1.3	86	1.7	70	2.3	45	3.3	48	4.1
Poisoning	170	1.1	47	0.9	67	1.3	27	0.9	16	c	12	c
Other ^e	585	3.7	217	4.2	166	3.3	111	3.7	38	2.8	45	3.8
Assault (homicide)	3,290	20.7	1,256	24.6	1,022	20.5	517	17.2	214	15.5	175	14.8
Complications of medical and surgical care ^f	200	1.3	82	1.6	54	1.1	37	1.2	16	С	9	c
Other external causes ^g	971	6.1	279	5.5	321	6.4	192	6.4	91	6.6	79	6.7

^aWeighted infant death counts and percentages; may not sum to total due to rounding.

^bTotal deaths due to external causes includes deaths among infants whose live birth order was unknown or not stated (n=189); this group is not presented separately in the table.

^cPercentage does not meet standards of reliability or precision.

^dQuantity zero.

eThe most frequent ICD-10 codes for other accidents across 2000-2010 included: exposure to unspecified factor (X59, n=186); exposure to excessive heat (X30, n=130); caught, crushed, jammed in or between objects (W23, n=86); and struck by thrown, projected or falling object (W20, n=44).

^fThe most frequent ICD-10 codes for complications of medical or surgical care across 2000-2010 included: surgical operation and other surgical procedures as the cause of abnormal reaction of the patient, or of later complication, without misadventure at the time of the procedure (Y83, n=84); and other medical procedures as case of abnormal reaction of the patient, or of later complication, without mention of misadventure at the time of the procedure (Y84, n=67). ^gThe most frequent ICD-10 codes for other external causes across 2000-2010 included: hanging, strangulation and suffocation of undetermined intent (Y20, n=473); unspecified event of undetermined intent (Y34, n=227); other specified event of undetermined intent (Y21, n=53).

Appendix Table 4. Infant Death due to External Causes by Selected Infant Death Characteristics and Live Birth Order, Singleton Births in the U.S., 2000-2010

Infant death characteristics		eaths due nal causes	F	irst	Se	cond	T	hird	Fo	urth	Fifth	or later
	n ^{a,b}	Per 10,000 births	nª	Per 10,000 births								
All	15,864	3.6	5,110	2.9	4,990	3.6	3,008	4.2	1,380	4.8	1,187	6.4
Age at death (days)												
Total neonatal	1,714	0.4	605	0.3	441	0.3	288	0.4	150	0.5	129	0.7
Early neonatal (under 7)	555	0.1	225	0.1	115	0.1	58	0.1	33	0.1	28	0.2
Late neonatal (7-27)	1,159	0.3	380	0.2	326	0.2	230	0.3	117	0.4	101	0.5
Post-neonatal (28-365)	5,302	1.2	1,737	1.0	1,651	1.2	1,024	1.4	454	1.6	404	2.2
Early post-neonatal (28-90)	4,486	1.0	1,399	0.8	1,483	1.1	865	1.2	391	1.4	319	1.7
Early middle post-neonatal (91-182)	2,517	0.6	790	0.4	811	0.6	489	0.7	221	0.8	193	1.0
Late middle post-neonatal (183-273)	1,846	0.4	579	0.3	605	0.4	341	0.5	165	0.6	142	0.8
Late post-neonatal (274-365)	555	0.1	225	0.1	115	0.1	58	0.1	33	0.1	28	0.2
External causes of mortality												
Accidents (unintentional injuries)	11,403	2.6	3,493	2.0	3,594	2.6	2,262	3.1	1,059	3.7	923	5.0
Transport accident	1,344	0.3	568	0.3	369	0.3	216	0.3	103	0.4	79	0.4
Falls	179	0.0	48	0.0	72	0.1	32	0.0	11	c	14	c
Firearms	5	с	1	c	2	с	1	с	1	c	d	c
Drowning/submersion	574	0.1	117	0.1	222	0.2	118	0.2	65	0.2	49	0.3
Accidental suffocation and strangulation in bed	5,663	1.3	1,684	0.9	1,757	1.3	1,161	1.6	545	1.9	480	2.6
Other	1,947	0.4	549	0.3	642	0.5	419	0.6	183	0.6	143	0.8
strangulation/suffocation												
Obstruction respiratory tract	619	0.1	195	0.1	210	0.2	106	0.1	53	0.2	51	0.3
Smoke, fire, flames	318	0.1	68	0.0	86	0.1	70	0.1	45	0.2	48	0.3
Poisoning	170	0.0	47	0.0	67	0.0	27	0.0	16	с	12	c
Other ^e	585	0.1	217	0.1	166	0.1	111	0.2	38	0.1	45	0.2

Assault (homicide)	3,290	0.7	1,256	0.7	1,022	0.7	517	0.7	214	0.7	175	0.9
Complications of medical and surgical care ^f	200	0.0	82	0.0	54	0.0	37	0.1	16	С	9	С
Other external causes ^g	971	0.2	279	0.2	321	0.2	192	0.3	91	0.3	79	0.4

^aWeighted infant death counts and percentages; may not sum to total due to rounding.

^fThe most frequent ICD-10 codes for complications of medical or surgical care across 2000-2010 included: surgical operation and other surgical procedures as the cause of abnormal reaction of the patient, or of later complication, without misadventure at the time of the procedure (Y83, n=84); and other medical procedures as case of abnormal reaction of the patient, or of later complication, without mention of misadventure at the time of the procedure (Y84, n=67).

gThe most frequent ICD-10 codes for other external causes across 2000-2010 included: hanging, strangulation and suffocation of undetermined intent (Y20, n=473); unspecified event of undetermined intent (Y34, n=227); other specified event of undetermined intent (Y33, n=73); and drowning and submersion of undetermined intent (Y21, n=53).

^bTotal deaths due to external causes includes deaths among infants whose live birth order was unknown or not stated (n=189); this group is not presented separately in the table.

^cPercentage does not meet standards of reliability or precision.

^dQuantity zero.

The most frequent ICD-10 codes for other accidents across 2000-2010 included: exposure to unspecified factor (X59, n=186); exposure to excessive heat (X30, n=130); caught, crushed, jammed in or between objects (W23, n=86); and struck by thrown, projected or falling object (W20, n=44).

Appendix Table 5. Risk Ratios for Live Birth Order and Infant Death due to External Causes by Birth Year, Singleton Births in the U.S., 2000-2010

Model/Year of birth	First	Second	Third	Fourth	Fifth or later
		RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
Unadjusted					
2000	1.0	1.1 (1.0, 1.3)	1.3 (1.1, 1.5)	1.5 (1.2, 1.9)	2.3 (1.9, 2.9)
2001	1.0	1.1 (1.0, 1.3)	1.4 (1.2, 1.7)	1.6 (1.3, 1.9)	2.4 (2.0, 3.0)
2002	1.0	1.3 (1.1, 1.5)	1.4 (1.2, 1.7)	1.7 (1.3, 2.1)	2.6 (2.1, 3.3)
2003	1.0	1.2 (1.1, 1.4)	1.3 (1.1, 1.5)	1.8 (1.4, 2.1)	2.0 (1.6, 2.5)
2004	1.0	1.4 (1.2, 1.6)	1.6 (1.3, 1.8)	2.1 (1.7, 2.5)	2.4 (1.9, 3.0)
2005	1.0	1.2 (1.0, 1.3)	1.4 (1.2, 1.6)	1.7 (1.4, 2.1)	1.8 (1.5, 2.3)
2006	1.0	1.3 (1.1, 1.4)	1.5 (1.3, 1.7)	1.6 (1.3, 1.9)	2.4 (2.0, 3.0)
2007	1.0	1.3 (1.1, 1.5)	1.5 (1.3, 1.7)	1.6 (1.3, 1.9)	1.9 (1.6, 2.4)
2008	1.0	1.3 (1.1, 1.4)	1.5 (1.3, 1.7)	1.6 (1.3, 1.9)	2.2 (1.8, 2.6)
2009	1.0	1.3 (1.1, 1.4)	1.4 (1.2, 1.6)	1.5 (1.2, 1.8)	2.1 (1.7, 2.6)
2010	1.0	1.4 (1.2, 1.6)	1.6 (1.4, 1.9)	1.8 (1.5, 2.2)	2.2 (1.8, 2.8)
Adjusted					
2000	1.0	1.6 (1.4, 1.9)	2.1 (1.8, 2.5)	2.6 (2.1, 3.3)	4.0 (3.1, 5.2)
2001	1.0	1.7 (1.4, 1.9)	2.3 (2.0, 2.8)	2.7 (2.1, 3.4)	4.4 (3.5, 5.7)
2002	1.0	1.9 (1.6, 2.2)	2.4 (2.0, 2.9)	3.0 (2.4, 3.8)	5.1 (4.0, 6.5)
2003	1.0	1.8 (1.6, 2.1)	2.1 (1.8, 2.5)	3.0 (2.4, 3.7)	3.6 (2.8, 4.7)
2004	1.0	1.9 (1.7, 2.2)	2.5 (2.1, 2.9)	3.5 (2.8, 4.3)	4.4 (3.5, 5.7)
2005	1.0	1.8 (1.6, 2.1)	2.5 (2.1, 2.9)	3.4 (2.7, 4.2)	4.0 (3.1, 5.1)
2006	1.0	1.9 (1.7, 2.2)	2.6 (2.2, 3.0)	2.9 (2.3, 3.5)	4.7 (3.7, 5.9)
2007	1.0	1.9 (1.7, 2.2)	2.5 (2.2, 3.0)	3.0 (2.4, 3.6)	4.0 (3.2, 5.1)
2008	1.0	1.9 (1.7, 2.2)	2.6 (2.2, 3.0)	3.0 (2.4, 3.6)	4.4 (3.5, 5.5)
2009	1.0	1.9 (1.6, 2.1)	2.4 (2, 2.8.0)	2.7 (2.2, 3.4)	4.2 (3.3, 5.2)
2010	1.0	2.0 (1.7, 2.2)	2.6 (2.2, 3.1)	3.1 (2.5, 3.8)	4.3 (3.4, 5.4)

Notes: Adjusted covariates included maternal age (<20, 20-24, 25-29, 30-34, 35-39, 40-54 years), race (Hispanic, non-Hispanic white, non-Hispanic black, other), education (no high school diploma or GED, high school diploma or GED, Bachelor's degree or higher, not stated or unknown) and marital status (married, unmarried).

GED, general educational development test